



BACKGROUND

1331 PENNSYLVANIA AVE. NW • SUITE 1500 - NORTH TOWER • WASHINGTON, DC 20004-1703

Understanding Carbon Dioxide (CO₂): Future Trends in Emissions and Emissions Control

Understanding CO₂

At the heart of the global climate change issue is the concern that increasing levels of greenhouse gases in the atmosphere could cause an enhanced greenhouse effect (a warming of the global climate beyond what might occur naturally) or "global warming." Some scientists believe that a man-made enhancement of the greenhouse effect will eventually become significant enough to cause changes in the Earth's climate. Although there are other greenhouse gases including NO_x, methane and HCFC's, CO₂ has been the primary target of efforts to reduce greenhouse gas emissions. Such efforts include proposed emissions limits, targets and timetables for reductions, and taxes on carbon or other energy sources.

It is important to understand that carbon dioxide is not a pollutant. It is a naturally occurring component of the atmosphere and is also a by-product of human, plant and animal respiration, a product of combustion, and a vital component of photosynthesis. Of the CO₂ that is emitted as a result of human activities, about half remains in the atmosphere, while the other half is removed by "sinks" which naturally absorb CO₂. Sinks for CO₂ include the ocean, soils and vegetation. Currently, our understanding of these sinks is limited, adding to the uncertainties surrounding predictions of the climate impact of rising CO₂ emissions.

Historical and Future Trends

Understanding the historical data on CO₂ emissions and global temperature provides clues to determining the relationship between increased atmospheric CO₂ levels and possible future changes in global mean surface temperature.

Carbon dioxide levels have varied widely during the Earth's history. Since the mid-1700s, atmospheric concentrations of CO₂ have risen 25 percent. This increase is largely a result of industrialization and the increased burning of fossil fuels as populations grow (resulting in increased living standards). The greatest increases in CO₂ emissions occurred after World War II. For example, between 1950 and 1988, the United States' annual CO₂ output roughly doubled.



Global temperatures can vary significantly with little or no change in greenhouse gas concentrations. For example, global mean temperatures rose 0.46° C between 1900 and 1995, but 67 percent of this increase took place before 1940. It is interesting to note that atmospheric CO₂ concentrations rose only 14.2 ppm between 1890 and 1940. These facts led the IPCC to conclude that this rapid increase in temperature was caused by natural forces.

*"The rather rapid changes in global temperature seen around 1920-1940 are very likely to have had a mainly natural origin."*¹

This means that natural forces, not greenhouse gases, have caused most, if not all, of the observed changes in global temperature during the 20th century.

Many forecasters agree that greenhouse gas levels could double sometime in the next century as a result of a number of factors, including: population growth, increased use of fossil fuels and increased economic activity in developing countries. Yet scientists cannot be certain whether the increased atmospheric concentrations of CO₂ or any other greenhouse gas will cause any significant climate change. One reason for this uncertainty is the inadequate representation of *feedback mechanisms* (i.e., interactions between climatic processes and greenhouse gases) in climate models. According to the IPCC:

*"GCMs[computer climate models] include many of the most important feedback mechanisms, such as vegetation, water vapor, ice cover, clouds, and the ocean. However, the models do not yet adequately represent the interactions of these mechanisms with greenhouse gases. Such interactions can amplify, dampen, or stabilize the warming produced by increased concentrations of greenhouse gases."*²

Future Sources of Increased CO₂ Emissions

According to the International Energy Agency, as much as 85 percent of the projected increase in manmade global CO₂ emissions will come from developing countries and countries with economies in transition (e.g., Eastern European nations and Russia). In fact, the U.S. contribution of manmade CO₂, which is less than 22 percent of total CO₂ emissions worldwide, has significantly declined over the past twenty years and will continue to decline. Additional reductions in the United States' CO₂ emissions would be relatively insignificant in the context of reducing global greenhouse gas concentration levels.

Policy Efforts to Control CO₂ Emissions

Most industrialized nations, including the United States, already have policies and programs in place that help to significantly reduce emissions of CO₂. In the United States, some studies show that existing programs (such as EPA's Green Lights Program) and policies (such as the Clean Air Act and the National Energy Policy Act of 1992) will come close to reducing CO₂

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emissions to 1990 levels by the year 2000. Many economic experts have concluded that the cost of radical reductions in greenhouse gas emissions in the United States would be enormous, perhaps overwhelming enough to cause severe unemployment, decreased international competitiveness of U.S. goods, and other grave economic disruptions.

Some economists believe that carbon dioxide emission reduction policies (i.e., carbon and other energy taxes) will only provide an incentive for carbon intensive industries to migrate to regions without such a tax. They say this movement to developing countries, where environmental regulations are significantly less stringent than the U.S., will result in more greenhouse gas emissions, not less.

As developed nations make progress toward reducing their emissions over the next decade, the greatest opportunities (and needs) for controlling the growth in CO₂ emissions will be in developing countries and countries with economies in transition. International policy efforts will need to be aimed at making the most of these opportunities by encouraging these nations to incorporate clean technologies into their economies. In fueling their economic growth, many developing nations now employ outdated or inefficient energy and environmental technologies and resource management techniques. For more information on reducing emissions in developing countries, see GCC's information backgrounder on Joint Implementation.

1. Climate Change, the 1990 IPCC Assessment, Cambridge University Press, section 7.12.
2. Global Warming: Limitations of General Circulation Models and Costs of Modeling Efforts. 1995. United States General Accounting Office. Document GAO/RCED-95-164. page 8.

The Global Climate Coalition is an organization of business trade associations and private companies established in 1989 to coordinate business participation in the scientific and policy debate on global climate change.

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